MEASLES IN NSW, 1991–2000

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Measles is an acute and highly-infectious viral disease. It is of public health importance because measles can cause serious illness and death. Each year, measles causes the death of almost a million children worldwide.[1] Vaccination against measles provides a high degree of protection (95 per cent protection after a single dose, and 99 per cent after two doses).[2] Available epidemiological evidence suggests that, in many parts of Australia, endemic measles circulation (that is, the ability of the virus to be sustained in the community) has been eliminated due to the achievement of high childhood vaccination rates.[3,4] There have been steady rises in vaccination rates among NSW children since the introduction of the Australian Childhood Immunisation Register, and since the 1998 National Measles Control Campaign, when over 75 per cent of NSW primary school children received a dose of measles, mumps and rubella vaccine (MMR).[5]

Symptoms of measles include fever, conjunctivitis, runny nose and cough. A typical red blotchy rash develops on day three to seven of the illness. Usually, the rash starts on the face and spreads down the body. Sometimes the rash peels.[6] Characteristic white spots called Koplik spots, which occur inside the mouth, may also help to distinguish measles from other illnesses. Complications of measles include pneumonia, ear infections, croup, diarrhoea and inflammation of the brain (encephalitis). Measles tends to be more severe in infants, in adults and in children who are malnourished.[6] Rarely, measles infection can cause subacute sclerosing panencephalitis, which is a type of progressive brain degeneration.

Humans are the only known host of the measles virus. Measles is one of the most highly communicable infectious diseases,[6] and is transmitted from person-to-person through airborne respiratory droplets or through direct contact with respiratory secretions. The incubation period between exposure and fever is usually 10 days, but may vary between 7–18 days, and the time between exposure to onset of rash is usually 14 days. Measles is infectious from one day before the beginning of the prodrome of illness to onset of rash until four days after the onset of rash.[6]

Measles surveillance in NSW enables the identification and vaccination of contacts at risk of infection in order to prevent the spread of measles among susceptible people. It also allows monitoring of the epidemiology of the disease to inform prevention strategies. The use of a laboratory technique, known as genotyping, can also facilitate the study of chains of transmission of measles, which help to identify the origin of the cases. Measles viruses are grouped into at least eight distinct genotypes, largely on the basis of the genes that code for proteins called haemagglutinin and nucleoprotein.[7] In this report we review the epidemiology of measles cases notified in NSW since 1991.

METHODS

Under the NSW Public Health Act 1991, all medical practitioners, hospital chief executive officers, laboratories, school principals, and directors of child care facilities, must notify suspected cases of measles to their local Public Health Unit (PHU). Case definitions incorporate:

- **suspected cases**: people with morbilliform (measles like) rash, fever present at the onset of rash and cough;
- **presumptive cases**: people with a morbilliform rash lasting at least 3 days, fever over 38.3° at rash onset and at least one of cough, coryza, conjunctivitis or Koplik spots;
- **confirmed cases**: people meeting the criteria for either suspected or presumptive case and either: laboratory proven measles infection (measles virus detected or IgM antibody to measles or rise in IgG antibody to measles in the absence of vaccination); or
- an epidemiological link with a confirmed infectious case.

PHU staff record the details of presumptive and confirmed cases on the confidential statewide Notifiable Diseases Database (NDD). We analysed the characteristics of notified cases from NDD during the period 1991 to 2000 by date of onset. Notification rates were calculated using mid-year population estimates from the Australian Bureau of Statistics (ABS) for each year. Additional information was sought from PHUs about all notifications since January 1999 to identify imported cases and clusters. PHU staff coordinate the collection of specimens for measles genotyping from at least one case in a cluster and at least two cases in an outbreak. These specimens are forwarded to the Victorian Infectious Diseases Reference Laboratory for virus culture in B95a cells and subsequent genotyping.[8]

The NSW Department of Health's Inpatients Statistics Collection (ISC) was used to identify hospital separations of NSW residents with an ICD-9 diagnosis code of 055 (measles). Data were only available for complete calendar years from 1994 to 1999. ABS Causes of Death data was reviewed to identify deaths from measles in NSW residents.

RESULTS

During the 10-year period, 6390 cases of measles were reported in NSW. Of these cases, 1183 (18.5 per cent) were confirmed by laboratory tests. The number of notifications that were laboratory confirmed fluctuated from year to year with the least number confirmed in 1991 (four per cent) and the most in 2000 (61 per cent). The least number of notifications were received in 1999 (32 notifications), which was also the first year in which no measles cases were reported in NSW for an entire month (September 1999). The highest number of notifications were received in 1993 (2348 notifications) (Table 1). The average annual incidence for the 10-year period was 10.4 notifications per 100,000 persons. Most cases of measles (51 per cent) occurred in the spring (Figure 1). The number of reported cases has remained low since the Measles Control Campaign of late 1998.

AGE AND SEX OF CASES

Over the 10-year period, 3243 cases (51 per cent) were male. However, the sex of 16 cases was not reported (0.3 per cent). By year, the percentage of males fluctuated between 41 per cent and 57 per cent.

By age group, most notifications were reported in children under five years of age (34 per cent of all notifications). Notifications in the under five year old age group peaked in 1993 at 150 per 100,000. By 2000 the rate had fallen to only 3.3 per 100,000. Proportionally, this age group has remained the most affected over time. Measles notifications overwhelmingly reflect that measles is a childhood disease. Ninety-six per cent of notifications over the 10-year period were in people under the age of 25 years (Figure 2, Figure 3).

VACCINATION STATUS

Since 1993, when measles vaccination status was routinely recorded on NDD, 1927 (38 per cent) of the 5079 notified cases did not have their vaccination status entered on NDD. Of the 3152 (62 per cent) cases with documentation of vaccination status, 1701 (54 per cent) reported previous vaccination against measles. In 2000, only 20 of the 36 notified cases (56 per cent) had their vaccination status reported; of these 20 cases 11 (55 per cent) reported previous vaccination against measles.

HOSPITALISATION AND MORTALITY

Between 1991 and the end of 2000, 431 hospitalisations are documented in notified measles cases listed in NDD (seven per cent of all notifications). In comparison, NSW ISC hospital separation data for the shorter period, 1994 to 1999 (when complete calendar year records are available) identifies 501 admissions with measles infection (Table 1). For the same period, NDD recorded only 169 hospitalisations; thus hospitalisation with measles is under-reported to public health units. Three deaths are recorded, which concur with the Australian Bureau of Statistics causes of death data for this period.

ENHANCED INFORMATION ABOUT NOTIFICATIONS SINCE JANUARY 1999

In 1999 and 2000, 68 measles cases were notified. Overall, 35 cases were laboratory confirmed and four further cases were identified as epidemiologically linked to a laboratory confirmed case: that is, 39 of the total 68 were confirmed (57 per cent). Of the remaining 29 presumptive cases, 24 were sporadic notifications in children with a clinical diagnosis alone and no source was identified. The other five cases were: three clinical diagnoses in tourists from countries where measles remains endemic; a clinical diagnosis in a child who had been interstate during the exposure period (that is, possible importation); and a clinical diagnosis in a nurse.

Of the 68 measles notifications, 10 (15 per cent) were identifiable as imported cases. Most of these cases were imported from countries in the Asia–Pacific region. A further six cases in NSW residents had an identifiable epidemiological link with one of the imported cases (see below).

Three clusters were identified in NSW:

- **cluster one** had seven cases, with transmission occurring between relations and playmates (no source identified; no genotyping available);[9]

TABLE 1

MEASLES NOTIFICATIONS, HOSPITALISATION AND DEATHS, NSW, 1991–2000

Year of onset	Notified cases	Rate /100,000	Rate /100,000 males	Rate /100,000 females	Laboratory confirmed	Hospital admissions	Deaths
1991	503	8.5	9.2	7.8	20 (4%)	NA	1
1992	808	13.6	13.3	13.8	76 (9%)	NA	2
1993	2348	39.1	40.0	38.0	460 (20%)	NA	0
1994	1484	24.5	24.2	24.6	302 (20%)	290	0
1995	596	9.7	10.8	8.7	138 (23%)	75	0
1996	191	3.1	3.0	3.1	35 (18%)	31	0
1997	273	4.4	4.4	4.3	98 (36%)	73	0
1998	119	1.9	2.2	1.6	19 (16%)	19	0
1999	32	0.50	0.4	0.6	13 (41%)	13	0
2000	36	0.56	0.5	0.6	22 (61%)	NA	0
Total	6390	10.4	10.6	10.1	1183 (18.5%)	501	3

NA=not available

- **cluster two** had at least five (and possibly seven) cases with spread acquired through a doctor's waiting room and child care centre (no source identified; genotype H identified in two cases);[10]
- **cluster three** was the largest cluster with 10 cases identified (seven notified in NSW residents) and affected predominantly young adults living and working in Northern Sydney (epidemiologically linked to an imported index case; genotype G2 identified in index case and in two other cases).[9]

Of the 24 notifications in those aged 15 years or over, at least three (12.5 per cent) occurred in health care workers and one occurred in an airport worker.

DISCUSSION

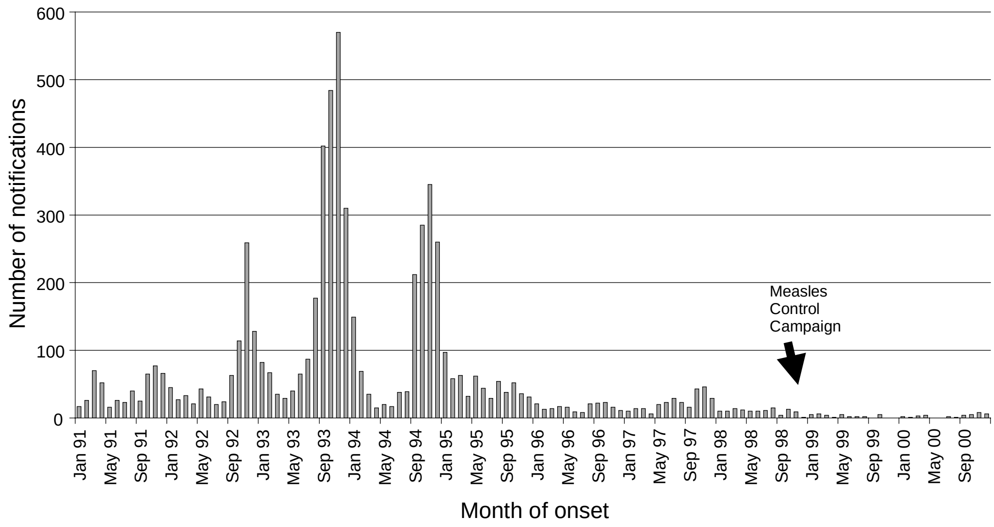
Measles incidence, as reflected by notification data, has dramatically declined in NSW over the last 10 years. The elimination of endemic measles in NSW is evidenced by the fact that when importation of the disease occurs secondary cases are uncommon and clusters are small. This remarkable achievement has only been possible with a comprehensive and coordinated strategy to achieve high immunisation rates. Maintenance of these rates will be critical to ensure ongoing measles control. Other countries, such as the United States of America, Canada, and the United Kingdom, have led the way in demonstrating that measles can be eradicated.[11] Australia, including NSW, is now monitoring the achievement of the WHO 'elimination phase' of measles control.[12,13] This phase refers to countries that have achieved high vaccination coverage and, in doing so, prevented periodic outbreaks. The objective is then to interrupt measles transmission completely. This phase shifts the emphasis onto following up and verifying all cases of measles to inform strategies for eliminating any gaps in a community's protection against the resurgence of measles. For example, in Australia young adults have been identified as a group at increased risk of measles.[14]

The current vaccination schedule incorporates measles vaccination as MMR (measles, mumps and rubella vaccine) for all children at the age of 12 months, with a second dose at four years of age. MMR coverage is at over 91 per cent by age 24–27 months.[15] The 1998 Measles Control Campaign was required to provide immediate and ongoing community immunity to measles when the recommendation for the timing of the second dose of MMR vaccine was brought forward from 10–16 years to four years of age. Although a single dose of MMR vaccine provides a high degree of immunity to individuals, in order to achieve sustained community immunity, a two dose schedule is required.[16] As can be evidenced from the available NSW notification data, many cases of measles occur in those reporting receipt of one dose of measles vaccine, reflecting that one in 20 people will not become immune after a single dose and perhaps that recollection of receipt of measles vaccination, especially in young adults, can be unreliable.[17]

As measles becomes rare, the proportion of false positive diagnoses and laboratory results will increase (as positive predictive value falls due to a low prevalence of measles.) In the current situation, care is required in interpretation of case definitions and the necessity for laboratory confirmation is reinforced, where possible using reference laboratories and confirmatory testing. It is quite possible that many of the sporadic notifications in children do not in fact represent measles. Where sporadic laboratory

FIGURE 1

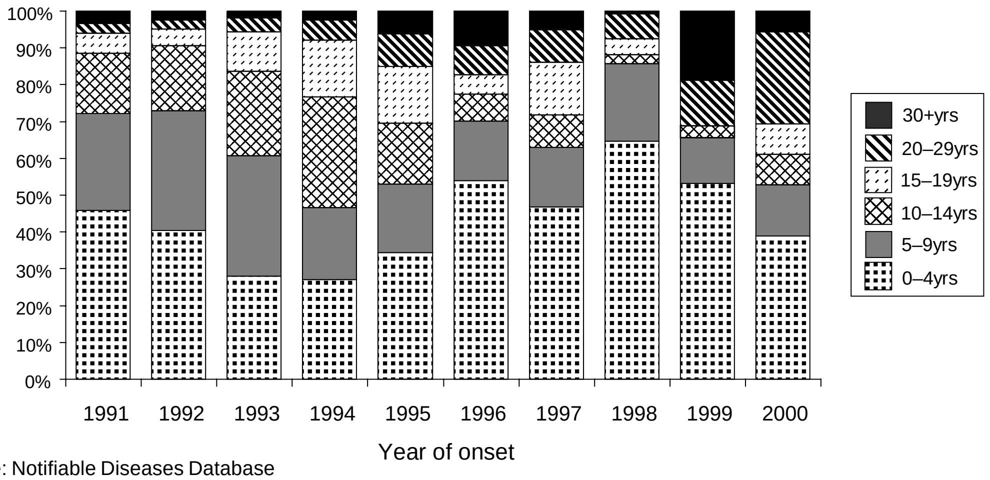
MEASLES NOTIFICATIONS BY DATE OF ONSET, NSW, 1999–2000



Source: Notifiable Diseases Database

FIGURE 2

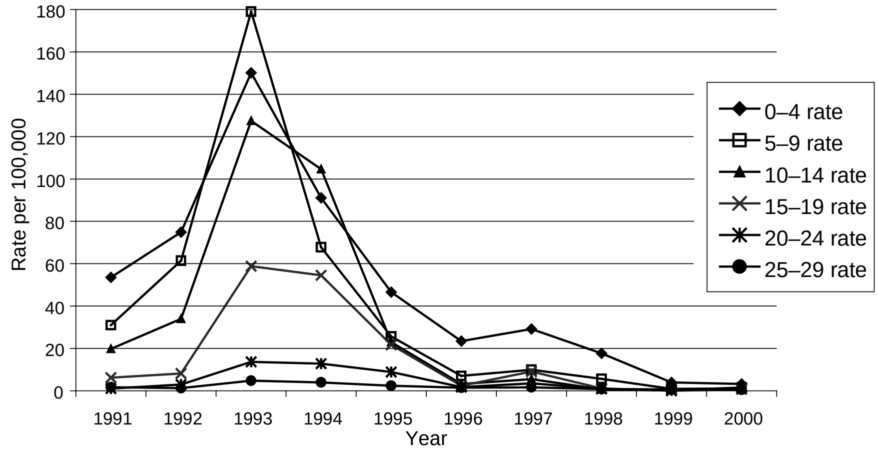
MEASLES NOTIFICATIONS BY AGE AND YEAR OF ONSET, NSW 1991–2000



Source: Notifiable Diseases Database

FIGURE 3

MEASLES NOTIFICATION RATES BY AGE GROUP TO AGE 30 YEARS, NSW, 1991–2000



Source: Notifiable Diseases Database

confirmed cases occur, the explanation may lie in the existence of unidentified overseas or interstate contacts, or with the problem of false positive IgM diagnosis.

Although the number of measles cases notified is falling and the proportion that are laboratory confirmed is increasing, the notification data demonstrates room for improvement; laboratory confirmation of all notified cases must be the goal. Similarly, while the NSW ISC data recorded many more hospitalisations with measles than NDD did, it may be that difficulties with diagnosis are also being reflected in the ISC data, leading to an overestimation of hospitalisations due to measles. For example, if measles is considered as a differential diagnosis it may appear in the coding for the admission without being confirmed. Recent enhancements to NDD, will allow easier differentiation of presumptive and confirmed cases and public health unit staff are now routinely recording information about clustering and importations of measles that will facilitate ongoing analysis of the NSW situation.

The NSW experience in 2001 to date is reflecting the patterns of the last few years. This year, a single imported case in a young adult resulted in a single second case in NSW but multiple cases interstate (epidemiologically linked to genotype D8).[8] Of the 12 notifications received to date for June 2001, almost half (five) occurred in either health care workers, overseas travellers or airport workers. The challenge remains to ensure that each and every child is protected against measles but in addition young adults who plan to travel overseas, or who work in health or travel, need to ensure that they are protected against measles infection through immunisation. Free MMR vaccine is currently available to 18–30 year olds as part of a national immunisation campaign.

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COMMUNICABLE DISEASES, NSW: JULY 2001

TRENDS

Notifications of illness caused by the mosquito-borne **Barmah Forest infection** increased during the three months to May in the Mid North Coast Area, where 51 cases were reported for May (Table 5). Fewer reports were received for this disease in other areas. In contrast, notifications for **Ross River virus infections** declined during the same period; and Hunter, Mid North Coast and Central Coast Areas, which are all on the coast north of Sydney, received the most reports of this illness.

This month we look at some data derived from the early stages of surveillance of **invasive pneumococcal disease** (IPD) and **shigellosis** (Figure 1). These conditions became notifiable by laboratories in early 2001. Data received suggest that the risk of **IPD** is higher among infants, and perhaps rural dwellers, although it is possible that statewide data is incomplete as all laboratories may not yet be prepared for reporting to their public health units. In contrast, data received on **shigellosis** cases suggests that it is overwhelmingly transmitted among Sydney men. Seventy-four per cent of case notifications (32 of a total of 43 cases) were in residents of South Eastern Sydney. In 2000, an outbreak of shigellosis was identified among men who have sex with men in inner Sydney. The identification was linked to venues that allow sex on premises.[1,2] The risk for shigella infection can be reduced by careful attention to hand-washing, especially after using the toilet, before handling food, before and after sex, and by avoiding contact with faecally-contaminated materials.

Laboratory staff are urged to check with their local public health unit to ensure that they are complying with notification requirements for these and other notifiable conditions.